

June 21, 1996

Refer to: HNG-14

Mr. Roger N. Egan  
Senior Vice President  
Sales & Marketing  
Energy Absorption Systems, Inc.  
One East Wacker Drive  
Chicago, Illinois 60601

Dear Mr. Egan:

You requested in your letter of June 6 to Mr. Gerald L. Eller that the QuadGuard be accepted as a National Cooperative Highway Research Program (NCHRP) Report 350 test level 3 (TL-3) crash cushion. We have reviewed the information on your company's QuadGuard crash cushion that was presented to us on June 5 and the supplemental information you mailed to us on June 14.

The QuadGuard tested was a six-bay unit, 6740 mm long and 760 mm wide. It consisted of a monorail assembly anchored to a concrete pad, steel diaphragms, specially-fabricated steel fender panels, a nose assembly, and a steel strut backup. Each bay contains an energy-absorbing cartridge identified as type 1 or type 2. Similar to the GREAT in function, the QuadGuard slows and stops vehicles impacting on the end and re-directs vehicles in side hits. Enclosure 1 shows the major components of the tested unit.

Enclosure 2 is a summary of the tests that were run and the results of each. After reviewing the individual test reports and the crash test videos that were provided to us, we agree that the QuadGuard tested meets the acceptance criteria for an NCHRP Report 350 TL-3 crash cushion.

However, since the QuadGuard will be used extensively to shield the ends of median barriers, it becomes critical that the transition design be adequate to prevent vehicles from snagging on the QuadGuard when the barrier is struck in a reverse-direction hit. Your drawings do not detail or dimension the transition designs to the extent that satisfactory performance can be inferred. There is a possibility that the fender panels could snag a vehicle in a wrong-way hit of the concrete barrier transition. Of greater concern is the transition design proposed for the QuadGuard transition to a w-beam median barrier. Because the design deflection of the w-beam median barrier is approximately 600 mm, the likelihood of a vehicle snagging at the transition cap or on the rigid tension strut seems high.

Based on the above, we consider the QuadGuard to be acceptable for use on the National Highway System (NHS) as a TL-3 attenuator *at locations where reverse-directions hits are*

*unlikely* when such use is requested by a highway agency. Once it has been demonstrated through crash testing that the concrete safety shape and w-beam median barrier transitions perform satisfactorily, the QuadGuard can be installed wherever it is deemed appropriate by the using agency. We believe two of the three transition designs you submitted should be tested, the concrete barrier transition and the w-beam median barrier transition. If the w-beam transition test results are satisfactory, we can assume a similar treatment for a thrie-beam median barrier would also be acceptable. Should you have any questions regarding these recommendations or wish to discuss the suggested tests in detail, please call Mr. James Hatton at (202) 366-1329 or Mr. Richard Powers at (202) 366-1320.

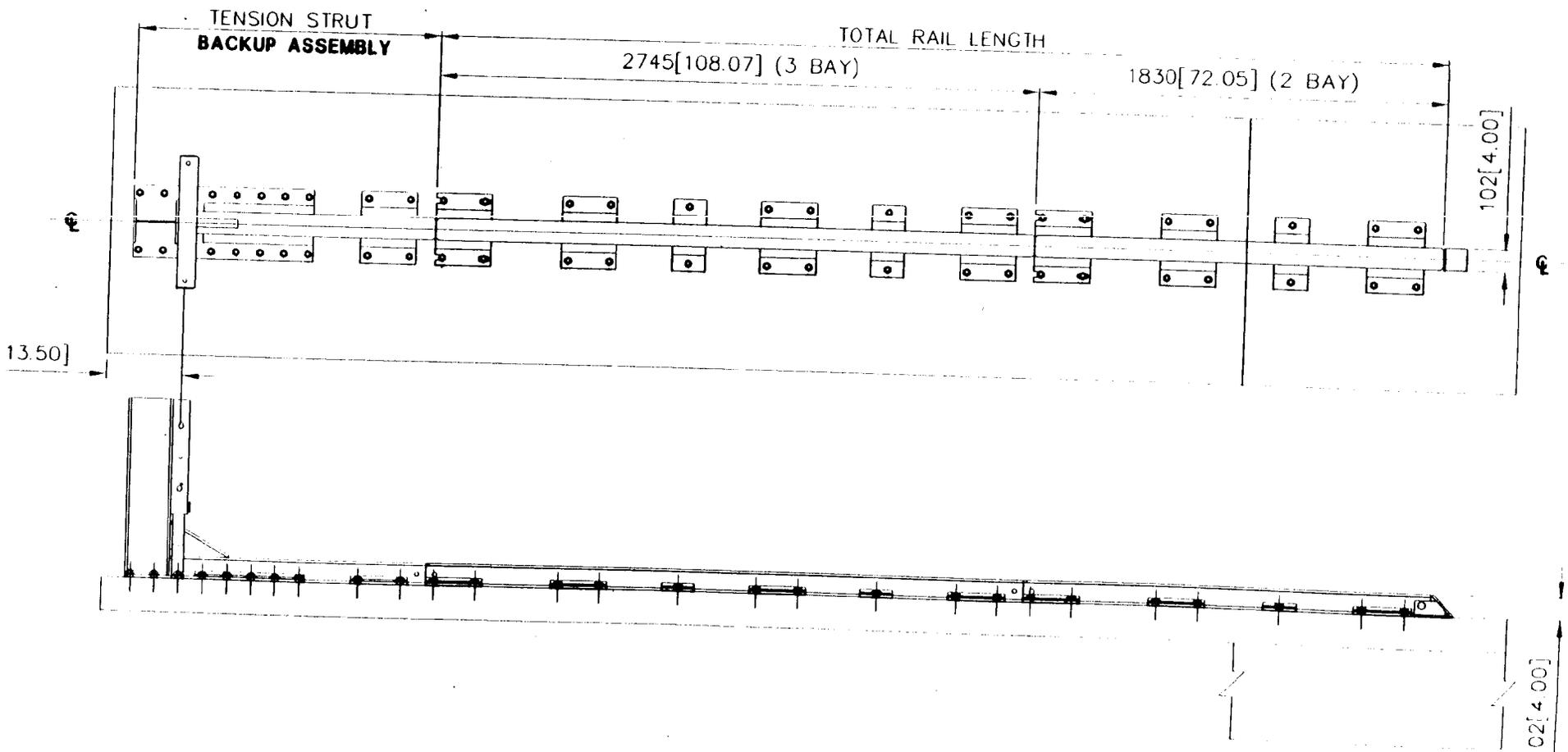
Since the QuadGuard is a proprietary device, its use on Federal-aid projects, except exempt, non-NHS projects, is subject to the conditions stated in Title 23, Code of Federal Regulations, Section 635.411, a copy of which is Enclosure 3.

Sincerely yours,

(original signed by James H. Hatton, Jr.)

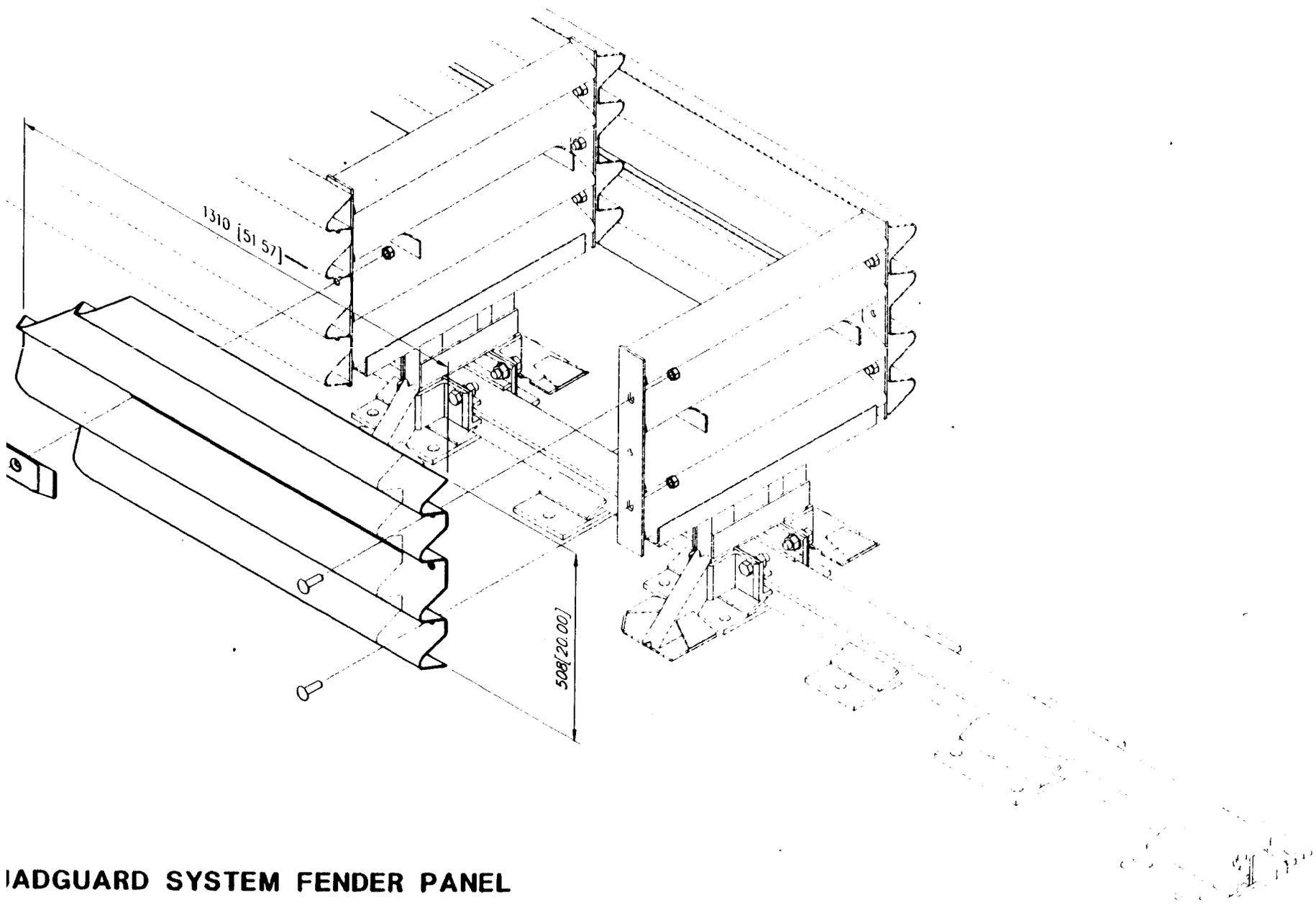
*for* Seppo I. Sillan, Acting Chief  
Federal-Aid and Design Division

3 Enclosures  
Acceptance Letter CC-35

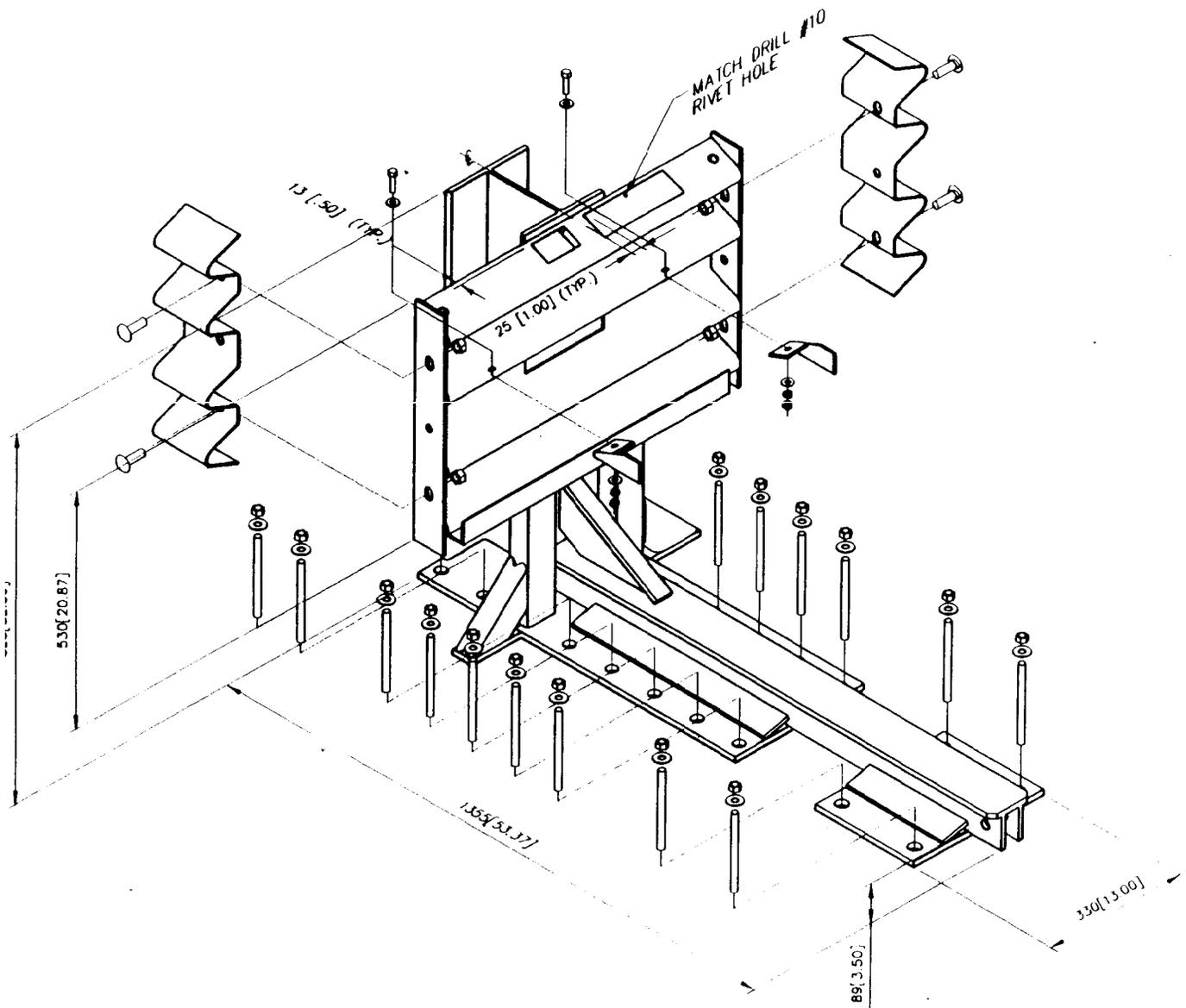


**QUADGUARD SYSTEM MONORAIL**

102 [4.00] Enclosure



**IADGUARD SYSTEM FENDER PANEL**



**QUADGUARD SYSTEM TENSION STRUT BACKUP**

## SUMMARY OF QUADGUARD CRASH TEST RESULTS

NCHRP 350 TEST DESIGNATION	"3-30"	"3-31"	"3-32"	"3-33"	"3-36"	"3-37"	"3-38"	"3-39"
E-TECH TEST NUMBER	01-7620-007	01-7620-006	01-7620-008	01-7620-005	01-7620-004	01-7620-002	01-7620-003	01-7620-001
VEHICLE MASS (kg)	845	2042	845	2045	819	2001	2001	1964
IMPACT SPEED (km/h)	99.33	98.56	98.36	97.11	100.54	100.2	98.56	98.56
IMPACT ANGLE (degrees)	0	0	15	15	15	21	21	21
IMPACT LOCATION	nose, w/4 offset	nose	nose	nose	BLON	BLON	CIP	L/2, Wrong Way
OCCUPANT IMPACT VEL. (m/s)								
LONGITUDINAL (12 m/s max.)	10.55	8.07	11.31	7.96	2.04	3.11	4.29	6.17
LATERAL (12 m/s max.)	2.11	0.16	1.1	0.38	6.09	6.5	6.35	6.24
OCCUPANT RIDEDOWN ACCEL, "g"								
(10 msec. average)								
LONGITUDINAL (20 "g" max.)	-14.52	-19.8	-15.23	-19.21	-3.38	-7.17	-10.91	-13.11
LATERAL (20 "g" max.)	-4.21	-2.81	-4.98	11.52	10.01	9.61	10.98	9.32
ASSESSMENT	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS

materials must occur in the United States.

The State has standard contract provisions that require the use of domestic materials and products, including steel materials, to the same or greater extent as the provisions set forth in this section.

The State elects to include alternate bid provisions for foreign and domestic steel materials which comply with the following requirements. Any procedure for obtaining alternate bids shall be based on furnishing foreign steel materials which is acceptable to the Division Administrator. The contract provisions must (1) require all bidders to submit a bid based on furnishing domestic steel materials, and (2) require the bidder who submits the lowest total bid based on furnishing domestic steel materials unless the total bid exceeds the lowest total bid based on furnishing foreign steel materials by more than 25 percent.

When steel materials are used in a contract, the requirements of this section do not prevent a minimal use of foreign steel materials, if the cost of foreign materials used does not exceed 0.1 percent of the total contract cost or \$2,500, whichever is greater. For purposes of this paragraph, the cost is that shown on the invoice for the steel products as delivered to the project.

(1) A State may request a waiver of the provisions of this section if: (a) The application of those provisions would be inconsistent with the public interest; or

(b) Steel materials/products are not available in the United States in sufficient and reasonably available quantities of a satisfactory quality.

A request for waiver, accompanied by supporting information, must be submitted in writing to the Regional Highway Administrator (RHA) through the FHWA Division Administrator. A request must be submitted sufficiently in advance of the time for the waiver in order to allow time for proper review and approval on the request. The RPHWA has approval authority on the re-

(3) Requests for waivers may be made for specific projects, or for certain materials or products in specific geographic areas, or for combinations of both, depending on the circumstances.

(4) The denial of the request by the RPHWA may be appealed by the State to the Federal Highway Administrator (Administrator), whose action on the request shall be considered administratively final.

(5) A request for a waiver which involves nationwide public interest or availability issues or more than one FHWA region may be submitted by the RPHWA to the Administrator for action.

(6) A request for waiver and an appeal from a denial of a request must include facts and justification to support the granting of the waiver. The FHWA response to a request or appeal will be in writing and made available to the public upon request. Any request for a nationwide waiver and FHWA's action on such a request may be published in the FEDERAL REGISTER for public comment.

(7) In determining whether the waivers described in paragraph (c)(1) of this section will be granted, the FHWA will consider all appropriate factors including, but not limited to, cost, administrative burden, and delay that would be imposed if the provision were not waived.

(d) Standard State and Federal-aid contract procedures may be used to assure compliance with the requirements of this section.

(23 U.S.C. 315, sec. 10 of Pub. L. 90-229, 90 Stat. 55, sec. 165 of Pub. L. 97-424, 90 Stat. 2136 and 49 CFR 1.48(b))

(48 FR 53104, Nov. 25, 1983, as amended at 49 FR 18621, May 3, 1984)

**§ 635.411 Material or product selection.**

(a) Federal funds shall not participate, directly or indirectly, in payment for any premium or royalty on any patented or proprietary material, specification, or process specifically set forth in the plans and specifications for a project, unless:

(1) Such patented or proprietary item is purchased or obtained through

**Federal Highway Administration, DOT**

competitive bidding with equally suitable unpatented items; or

(2) The State highway agency certifies either that such patented or proprietary item is essential for synchronization with existing highway facilities, or that no equally suitable alternate exists; or

(3) Such patented or proprietary item is used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes.

(b) When there is available for purchase more than one nonpatented, nonproprietary material, semifinished or finished article or product that will fulfill the requirements for an item of work of a project and these available materials or products are judged to be of satisfactory quality and equally acceptable on the basis of engineering analysis and the anticipated prices for the related item(s) of work are estimated to be approximately the same, the PS&E for the project shall either contain or include by reference the specifications for each such material or product that is considered acceptable for incorporation in the work. If the State highway agency wishes to substitute some other acceptable material or product for the material or product designated by the successful bidder or bid as the lowest alternate, and such substitution results in an increase in costs, there will not be Federal-aid participation in any increase in costs.

(c) A State highway agency may require a specific material or product when there are other acceptable materials and products, when such specific choice is approved by the Division Administrator as being in the public interest. When the Division Administrator's approval is not obtained, the item will be nonparticipating unless bidding procedures are used that establish the unit price of each acceptable alternative. In this case Federal-aid participation will be based on the lowest price so established.

(d) Appendix A sets forth the FHWA requirements regarding (1) the specification of alternative types of culvert pipes, and (2) the number and types of such alternatives which must

be set forth in the specifications for various types of drainage installations.

(e) Reference in specifications and on plans to single trade name materials will not be approved on Federal-aid contracts.

**§ 635.413 Guaranty and warranty clauses.**

(a) Except as provided in paragraph (b) of this section, clauses that require the contractor to guarantee or warrant materials and workmanship or to otherwise maintain the work for a specified period after its satisfactory completion by the contractor and its final acceptance by the State, will not be approved for use in Federal-aid contracts. Work performed and materials replaced under such guaranty or warranty clauses after final acceptance of work are not eligible for Federal participation.

(b) Contracts which involve furnishing and/or installing electrical or mechanical equipment should generally include contract clauses that require:

(1) Manufacturer's warranties or guarantees on all electrical and mechanical equipment consistent with those provided as customary trade practice; or

(2) Contractors' warranties or guarantees providing for satisfactory in-service operation of the mechanical and electrical equipment and related components for a period not to exceed 6 months following project acceptance.

**§ 635.417 Convict produced materials.**

(a) Materials produced by convict labor may only be incorporated in a Federal-aid highway construction project if such materials have been:

(1) Produced by convicts who are on parole, supervised release, or probation from a prison or

(2) Produced in a qualified prison facility and the cumulative annual production amount of such materials for use in Federal-aid highway construction does not exceed the amount of such materials produced in such facility for use in Federal-aid highway construction during the 12-month period ending July 1, 1987.

(b) *Qualified prison facility* means any prison facility in which convicts,